

***Cybaeus hatsushibai* n. sp. (Araneae: Cybaeidae) from Mt. Odaigahara, Honshu, Japan, with notes on geographic distribution and body size of its closely related species.**

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Abstract — A new medium-sized species of the genus *Cybaeus* (Araneae: Cybaeidae) from Mt. Odaigahara, Honshu, Japan, is described under the name *C. hatsushibai*. The new species shows close similarities to *C. aquilonalis* inhabiting central to northern Honshu and the southwestern part of Hokkaido and *C. aokii* of central to eastern Hokkaido in external and genital morphology and they are allopatric in their distributions. Thus, they can be recognized as members of a single superspecies. It was found that in *C. aquilonalis*, the body size tends to be larger in populations in the northernmost Honshu and Hokkaido than those in the central Honshu. On the other hand, *C. aokii*, which seems to be allopatrically or parapatrically found in Hokkaido to the distributional range of *C. aquilonalis*, was much smaller than the latter.

Key words — Cybaeidae, *Cybaeus hatsushibai* n. sp., *Cybaeus aquilonalis*, *Cybaeus aokii*, geographic distribution, geographic variation, body size.

In the present paper, I will describe a new species of the genus *Cybaeus* (Cybaeidae) collected from Mt. Odaigahara area, which has been designated as special protection zone in the Yoshino-Kumano National Park, in southernmost part of central Honshu, Japan. The spider fauna in Mt. Odaigahara has been investigated for two years (2003 and 2004) for one of the projects of the survey by the Ministry of Environment. Through the kindness of Mr. Shingo Hatsushiba, I was able to examine several specimens of the genus *Cybaeus* that had been collected during the survey.

Local species assemblage of the genus in Mt. Odaigahara area was clarified by the survey. That consisted of six species differing one another in body size or coloration. They were *C. nipponicus* (Uyemura 1938), *C. kiuchii* Komatsu 1965 and four unsettled species, which are medium- to small-size. (Although *C. yoshiakii* Yaginuma 1968 was also occurred in Odaigahara, it is considered that this species does not belong to the genus *Cybaeus*.) A close examination of morphology and geographic distribution revealed that one of the medium-sized species is clearly recognized a new species. This new species has affinities with *C. aquilonalis* Yaginuma 1958 and *C. aokii* Yaginuma 1972 in external and genital morphology. In addition, these three species are allopatric in their distribution. Consequently, they should be treated as members of a closely related species group that may constitute a single superspecies.

Materials and Methods

Specimens examined

Specimens of the present new species were collected during the “Survey of the Odaigahara area for restoration of forest ecosystem” by the Ministry of Environment. The type specimens designated in this paper are deposited in the National Science Museum (Natural History), Tokyo. Other specimens are in my personal collection. Data of the specimens will be given by the following order: locality, number of individuals, date collected, and name of the collector.

Morphological examinations

All the measurements were made for the specimens immersed in 80% ethanol under a stereo dissecting microscope with an ocular micrometer. Since the specimens preserved in ethanol were frequently extended in joint of cephalothorax and abdomen, exact measurements of the body length were unavailable. Accordingly, carapace length is adopted as indicator of body size.

Female genitalia removed from the abdomen were cleared in hot 10% KOH and 3% H₂O₂ according to the method described in Komatsu & Yaginuma (1968) to observe internal sclerotized structure.

Recognition of species

Each of the local species assemblages of the genus *Cybaeus* generally consists of several species, which are separable by many morphological differences one another.

They can be recognized as distinct biological species within the local species assemblage by their sympatry without any indication of hybridization. On the other hand, each species of the assemblage often is a component species of closely related species group. In this case, each species occupies a fragment within an overall geographic range of the group. It gives parapatric or allopatric pattern to the distribution except for some cases of narrow overlap. This pattern has proved to be widespread in spiders of the genus *Cybaeus* in Japan (Ihara 1993, 2003; Ihara & Nojima 2004).

When closely related forms are completely allopatric, it is difficult to judge objectively whether they should be treated as several distinct species or a polytypic single species. In this study, since there is little evidence of reproductive isolation, species delimitation within the group is an open question. However, I treat a series of geographical forms (=nominal species and new species) as distinct biological species on the basis of presence of distinct morphological gaps in genital morphology substantially serve to separate one form from other adjacent forms.

Description

Cybaeus hatsushibai n. sp.

[Japanese name: Ôdaigahara-namihagumo]
(Figs. 1A-D, 2A-B, 3A-B, E-F, I, 4A, E)

Diagnosis. The species can be easily distinguished from the other species of the same local species assemblage (*C.*

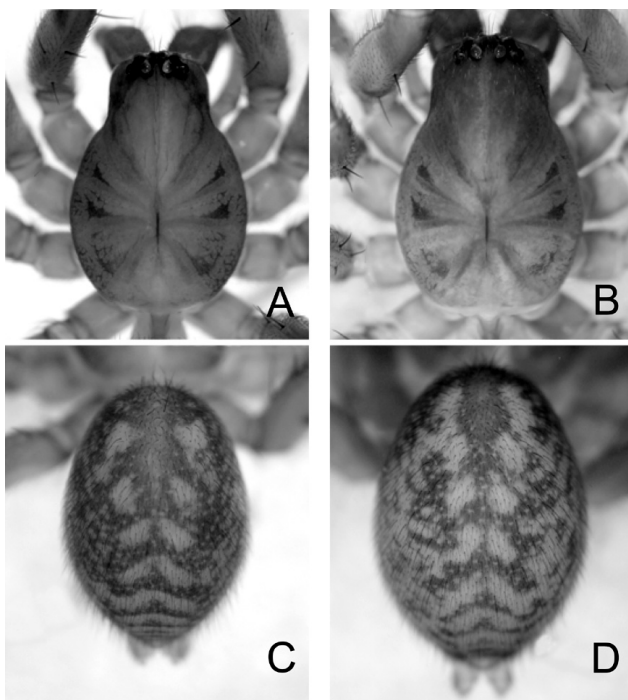


Fig. 1. Shape of carapace and coloration pattern of abdomen of *Cybaeus hatsushibai*: A, C male (holotype); B, D female (paratype) — A-B carapace, dorsal view; C-D abdomen, dorsal view. (Scale: 1.0 mm).

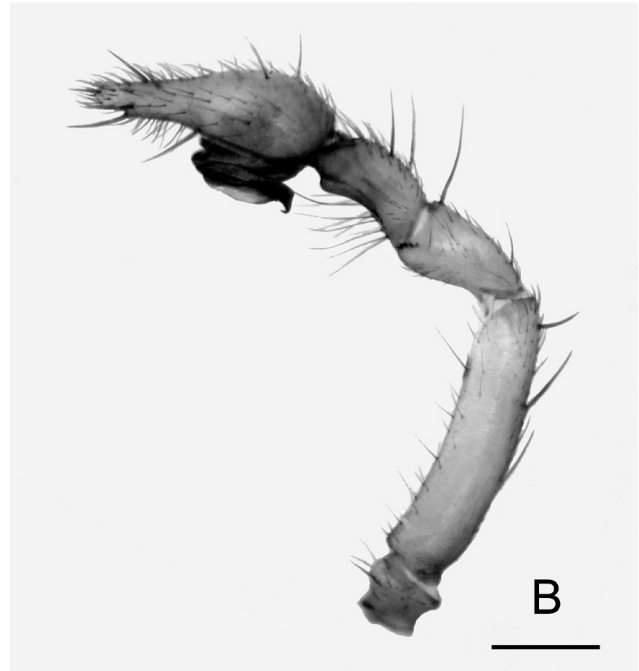
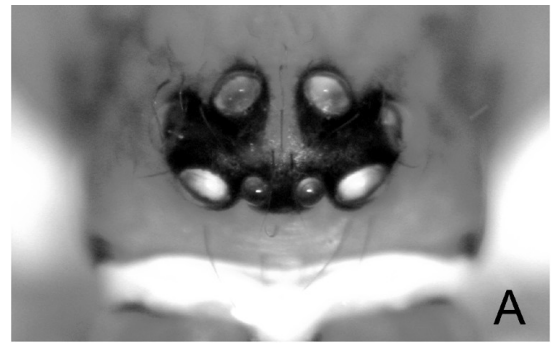


Fig. 2. *Cybaeus hatsushibai* n. sp. (male, holotype) — A ocular area, frontal view; B left palp, lateral view. (Scale: 0.5 mm)

nipponicus, *C. kiuchii* and four unsettled species) by having relatively thick and short male palp, and a brownish body medium in size. This species shows close affinities with *C. aquilonalis* inhabiting central and northern Honshu and southern Hokkaido and *C. aokii* of Hokkaido in body size, coloration, and male and female genital organs, though details of the genital organs serve to separate the three species substantially (e.g. male palpal patella is more sharply protruded distally as in Fig. 3A in *C. hatsushibai*).

Description. Male (holotype). Measurements (in mm). Body length 6.75; carapace length 3.38, width 2.32, head region width 1.29; abdomen length 3.45, width 2.36; sternum length 1.60, width 1.44; labium length 0.40, width 0.51. Length of legs (femur/ patella/ tibia/ metatarsus/ tarsus; total): Leg I: 2.70/ 1.06/ 2.59/ 2.57/ 1.68; 10.60. Leg II: 2.60/ 1.06/ 2.24/ 2.42/ 1.55; 9.87. Leg III: 2.34/ 1.00/ 1.70/ 2.29/ 1.32; 8.65. Leg IV: 2.86/ 1.05/ 2.46/ 3.30/ 1.66; 11.33.

Head region narrow, ratio of width to thoracic region

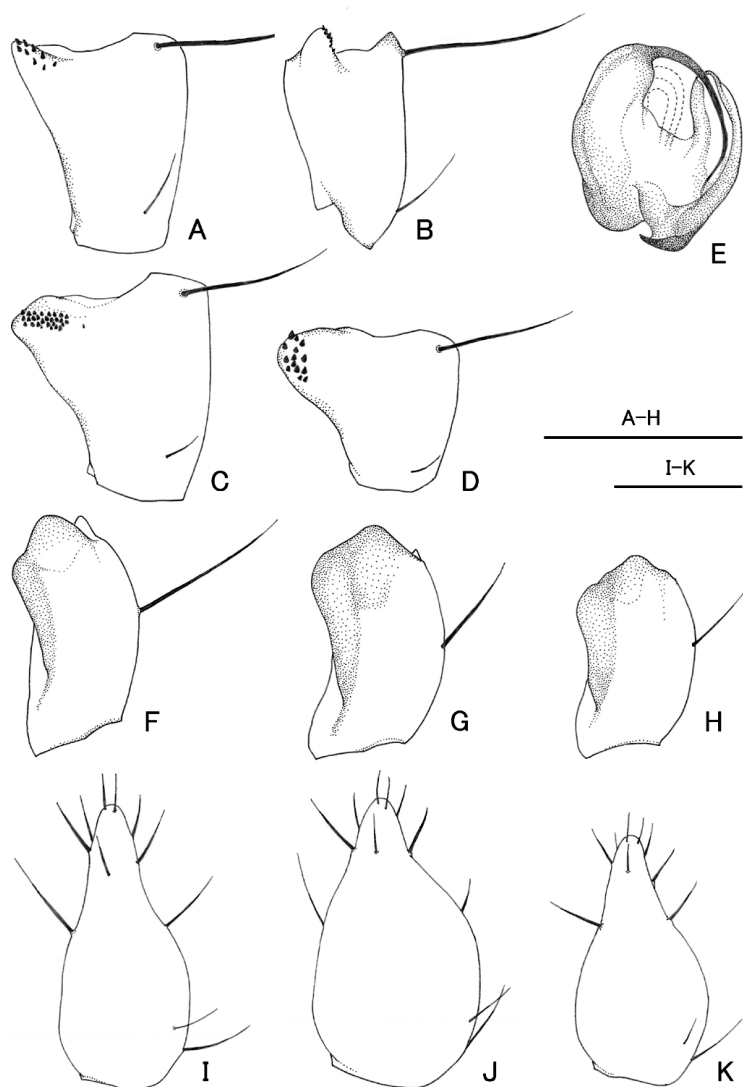


Fig. 3. Male left palp of *Cybaeus hatsushibai* and its closely related species: A-B, E-F, I *C. hatsushibai* (holotype); C, G, J *C. aquilonalis* (Yonezawa-shi, Yamagata Prefecture); D, H, K *C. aokii* (Shikaoi-cho Hokkaido) — A, C-D patella, dorsolateral view; B patella, lateral view; E, genital bulb, ventral view; F-H, tibia, lateral view; I-K, cymbium, dorsal view. (Scale: 0.5 mm)

0.56 (Fig. 1A). Thoracic region as high as head region. Anterior eye row straight as seen from front, posterior eye row straight as seen from above. Diameter of anterior median eyes the smallest, about half to other eyes. Ocular area about twice as wide as long, ratio of width to length 1.86 (Fig. 2A). Clypeus considerably short, ratio of length to median ocular area 0.44. Chelicera geniculate in front, promargin of fung furrow with 3 teeth, retromargin with 8 teeth and denticles, and basally with lateral condyle. Length of legs: $4 > 1 > 2 > 3$. Tibia I with 2-2-2-2 ventral spines and 2 prolateral spines and 2 retrolateral spines; metatarsus I with 2-2-2 ventral spines, 4 prolateral spines and 1 retrolateral spine; tibia II with 2-2-1(retromargin)-2 ventral spines and 4 prolateral spines and 2 retrolateral spines; metatarsus II 2-2-3 ventral spines, 4 prolateral spines and 4 retrolateral spines.

Palp (Figs. 2B, 3A-B, E-F, I). Relatively thick and short in proportion. Patella with a short but sharp apophysis furnished with small conical teeth. Tibia as long as patella. Genital bulb relatively small, conductor simple without

apical element of embolus.

Coloration. Carapace bright brown with reticulate brownish black markings on lateral sides of the head and radical bands on the thorax. Chelicerae, maxillae, labium and sternum yellowish brown; chelicerae darker than the others. Legs yellowish brown with dark grayish annulations. Dorsum of abdomen olive black with dull yellow chevron pattern as shown Fig. 1C.

Female. Measurements (in mm; paratype). Body length 7.20; carapace length 3.55, width 2.45, head region width 1.57; abdomen length 3.65, width 2.53; sternum length 1.68, width 1.52; labium length 0.43, width 0.56. Length of legs (femur/ patella/ tibia/ metatarsus/ tarsus; total) as follows. Leg I: 2.56/ 1.15/ 2.46/ 2.18/ 1.20; 9.55. Leg II: 2.60/ 1.16/ 2.16/ 2.10/ 1.20; 9.22. Leg III: 2.34/ 1.08/ 1.74/ 2.06/ 0.98; 8.20. Leg IV: 2.76/ 1.09/ 2.38/ 2.92/ 1.28; 10.43. Tibia I with 2-2-2-2 ventral spines and 2 prolateral spines; metatarsus I with 2-2-2 ventral spines, 1 prolateral spine and 1 retrolateral spine; tibia II with 2-2-1(retromargin)-2 ventral spines and 3 prolateral spines; metatarsus II 2-2-3 ventral

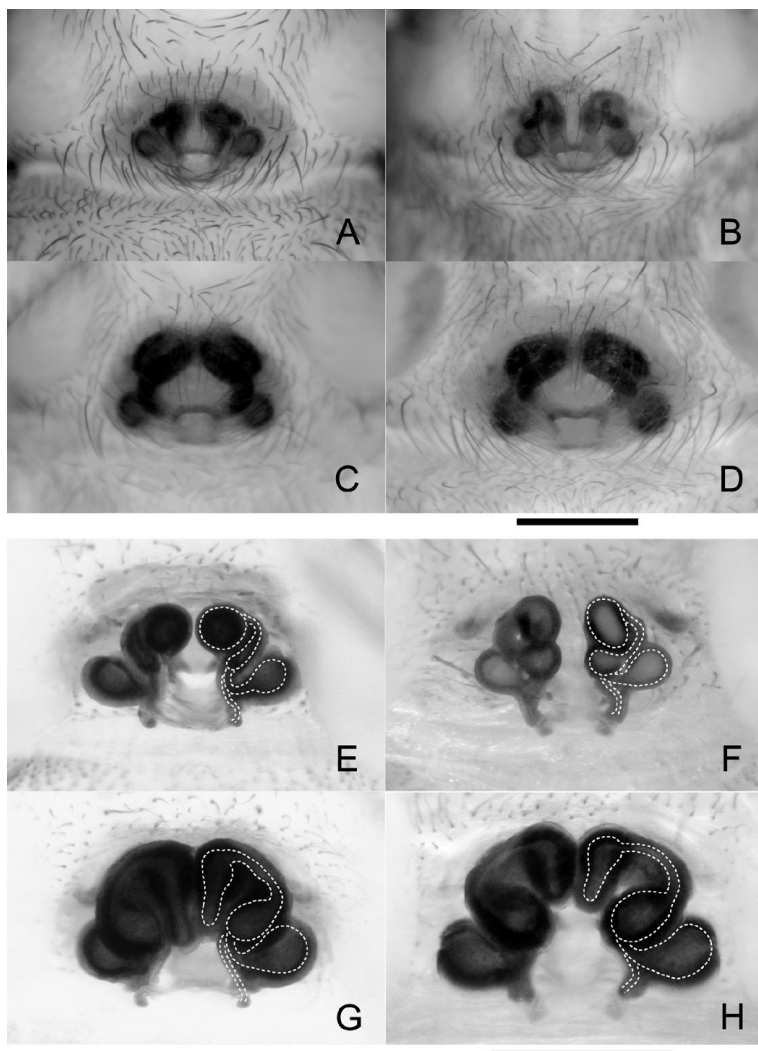


Fig. 4. Female genitalia of *Cybaeus hatsushibai* and its closely related species: A, E *C. hatsushibai* (paratype); B, F *C. aokii* (B Shikaoi-chô, F Kamishihoro-chô, Hokkaido); C, G *C. aquilonalis* (Yonezawa-shi, Yamagata Prefecture); D, H *C. aquilonalis* (Hakodate-shi, Hokkaido) — A-D epigynum, ventral view; E-H internal structure, dorsal view. (Scale: 0.5 mm)

spines, 4 prolateral spines and 1 retrolateral spine.

Similar to male in coloration. Carapace longer than male. Head region large, ratio of width to thoracic region 0.64 (cf. Fig. 1B with 1A). Abdomen larger and more rounded (Fig. 1D), legs shorter than those of male.

Genitalia (Fig. 4A, E). Epigynum simple, posteriorly with small opening, and anteriorly internal structure conspicuous through the integument.

Specimens examined. Type series. Mt. Odaigahara, Kami-Kitayama-mura, Yoshino-gun, Nara Prefecture, Japan: holotype (♂), 23-X-2003, Toshio Kishimoto leg.; paratype (♀), 10-VIII-2004, Takeshi Horiguchi leg.

Other specimens. Same locality as the type series: 1♂2♀, 23-X-2003, T. Kishimoto; 3♂1♀ 24-X-2003, T. Kishimoto; 1♀, 10-VIII-2004, Shingo Hatsushiba; 1♂, 10-VIII-2004, T. Horiguchi; 1♀, 11-VIII-2004, S. Hatsushiba; 1♂, 11-VIII-2004, T. Horiguchi; 2♀, 12-VIII-2004, S. Hatsushiba; 2♂, 13-VIII-2004, T. Horiguchi.

Variation. Since the species is known from the type locality alone, the information was not acquired for geographic variation.

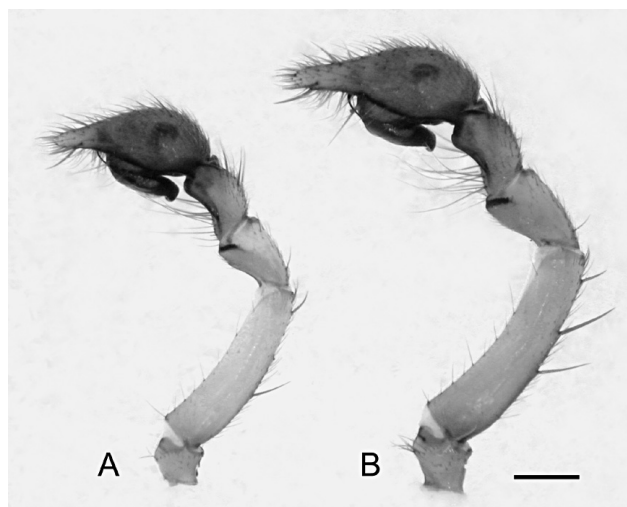


Fig. 5. Geographic variation in the size of male palp of *Cybaeus aquilonalis*: left palp, lateral view — A Yonezawa-shi, Honshu, B Hakodate-shi, Hokkaido. (Scale: 0.5 mm)

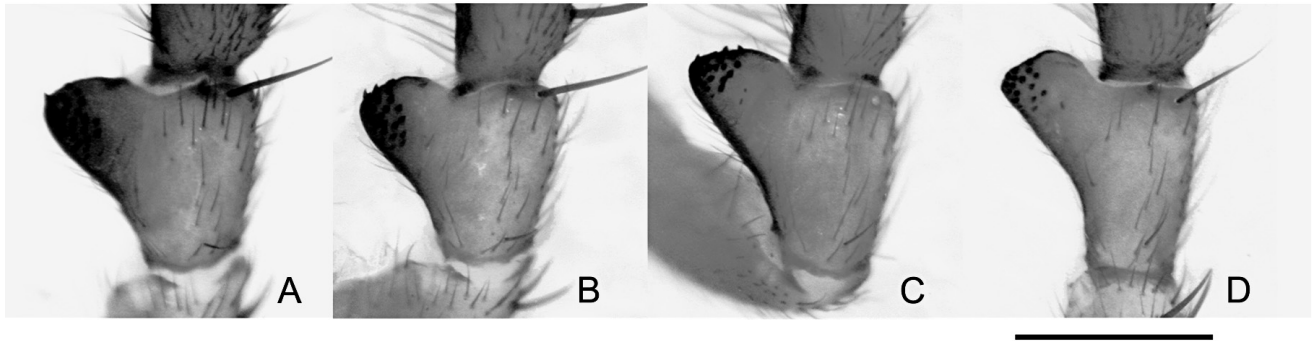


Fig. 6. Geographic variation in the shape of male palp of *Cybaeus aokii*: patella of left palp, dorsolateral view — A Kamishihoro-chô, B Shari-chô, C Akan-chô, D Ashoro-chô. (Scale: 0.5 mm)

Range of body size as shown Fig. 8 (in mm, means in parentheses; male $n=9$, female $n=8$): Carapace length, 3.04–3.51 (3.34) in male, 3.46–3.85 (3.54) in female; carapace width, 2.06–2.50 (2.35) in male, 2.31–2.70 (2.44) in female.

Closely related species of *Cybaeus hatsushibai*

Since *Cybaeus hatsushibai* shows close similarities to *C. aquilonalis* and *C. aokii* in external and genital morphology, they can be recognized to constitute a closely related species group.

Cybaeus aquilonalis Yaginuma 1958
[Japanese name: Ko-namihagumo]
(Figs. 3C, G, J, 4C-D, G-H, 5A-B)

Cybaeus aquilonalis Yaginuma 1958, p. 76, fig. 27 (male holotype from the Hiyamizu Pass, Aomori prefecture, 17-VIII-1957, preserved in Laboratory of Biology, Ohtemon Gakuin University, examined); Yaginuma 1986, p. 143, fig. 78 (11); Ihara 2004, p. 41, figs. 9A-C, 10A-C.

Description. See Yaginuma (1958) in male and Ihara

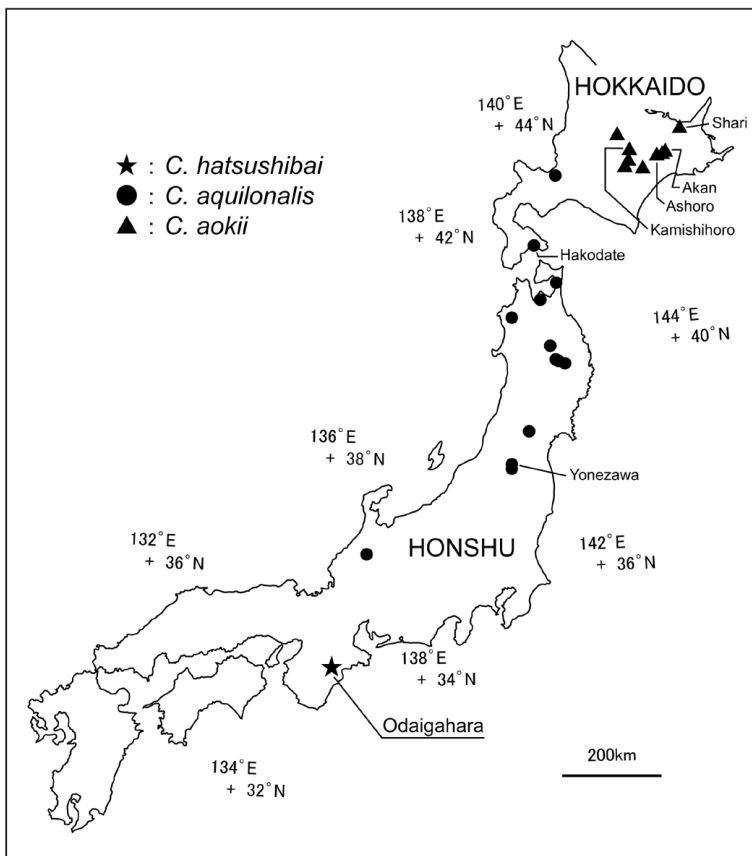


Fig. 7. Distributions of *Cybaeus hatsushibai*, *C. aquilonalis* and *C. aokii*.

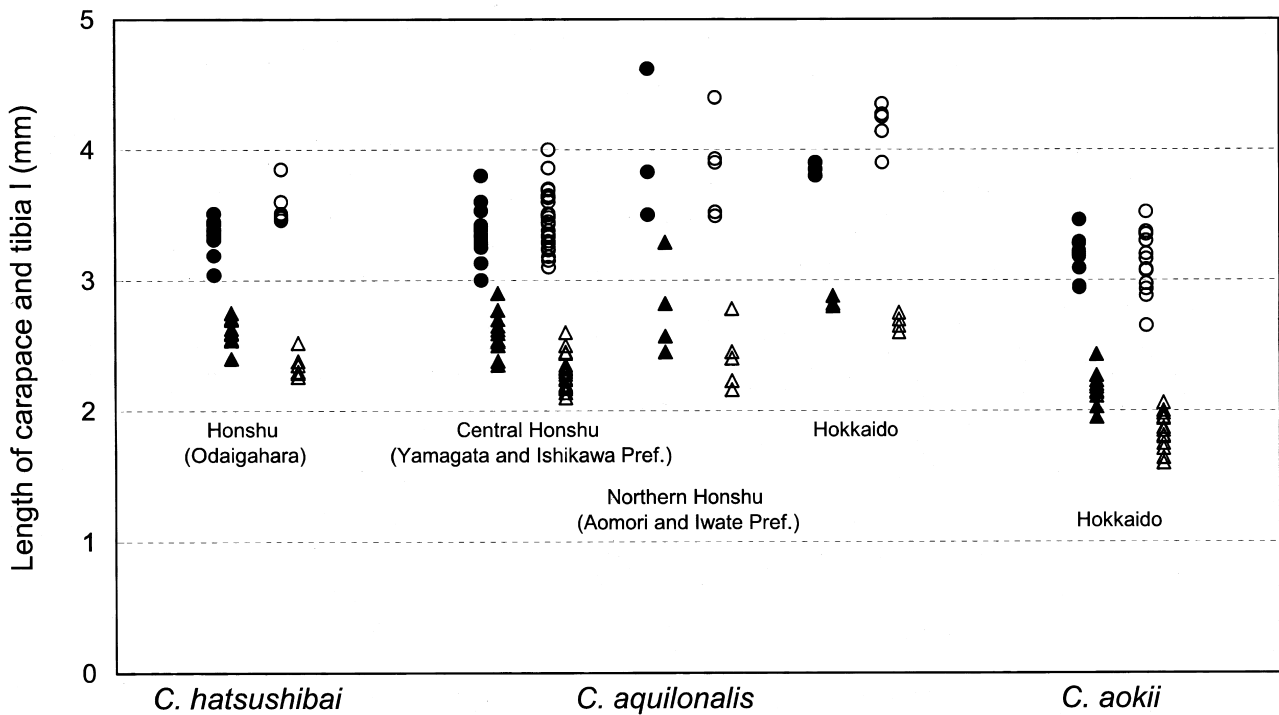


Fig. 8. Intra- and interspecific body size variation in the group of closely related species. Length of carapace (circles) and tibia of leg I (triangles) of *Cybaeus hatsushibai*, *C. aquilonalis* and *C. aokii*. (solid: males, open: females)

(2004) in female.

Specimens examined. HOKKAIDO Sapporo-shi: Maruyama, 1♂, 19-IX-1996, NT; Atsubetsu-ku, 2♂2♀, 30-VIII-1999, Osamu Watanabe et al. Hakodate-shi: Mt. Hakodate, 3♀, 8-IX-1995, NT. — AOMORI PREF. Aomori-shi, Takisawa, 1♀, 2-X-1997, TS. Nakatsugaru-gun, Nishimeya-mura, Kawaratai, 1♂, 15-VII-1998, TS; Asagishi, Ôshida, 1♀, 28-IX-1995, Tomoo Sasaki, 1♀, 29-IX-1995, TS; Kamiyonai, 29-IX-1995, 1♀, T. Sasaki. Ichinoseki-shi, Genbi-chô, 1♀, 31-VIII-1994, T. Sasaki. Kamaishi-shi, Ôdaira-chô, 1♂, 23-X-1997, T. Sasaki. Iwate-gun, Nishine-cho, Terada, 1♂, 10-VIII-1998, T. Sasaki. YAMAGATA PREF. Yonezawa-shi: Seki, 1♂5♀, 28-VIII-1995, Y. Ihara; 2♂6♀, 28-VIII-1995, Koichi Nojima; Shirabu Pass, 2♀, 28-VIII-1995, K. Nojima. Obanazawa-shi, Mt. Goshô-zan, 8♂8♀, 17-VIII-1986, Hajime Yoshida. ISHIKAWA PREF. Ishikawa-gun, Yoshinodani-mura, Hakusan toll road, 2♂4♀, 22-VIII-1994, Y. Ihara.

Variation. *Cybaeus aquilonalis* has a relatively broad range of distribution extending from central Honshu to Hokkaido (Fig. 7). It seems that sizes of body and epigynum tend to be larger in northern localities in the range of distribution (cf. Fig. 4C, G and D, H). Size difference is also found in male palp between Honshu and Hokkaido (Fig. 5).

Cybaeus aokii Yaginuma 1972
[Japanese name: Ezo-namihagumo]
(Figs. 3D, H, K, 4B, F, 6A-D)

Cybaeus aokii Yaginuma 1972, p. 25, figs. 7–8 (type-series from Mt. Poroshiri-dake, Hokkaido, female holotype, 24-VII-1971 and male paratype, 27-VII-1971, preserved in the National Science Museum, Tokyo, not examined); Yaginuma 1986, p. 143, fig. 78 (9).

Description. See Yaginuma (1972).

Specimens examined. HOKKAIDO. Kamikawa-gun, Kamikawa-chô, Mts. Daisetsu-zan, Mt. Kurodake, 3♂1♀, 3-IX-1980, Nobuki Yasuda. Shari-gun, Shari-chô, The Shari-gawa Valley, 1♂1♀, 15-IX-1996, Mitsuru Ban. Akan-gun, Akan-chô: Mt. Fuppushidake, Shirikomabetsu, 2♂3♀, 23-IX-1996, N. Tsurusaki; Trailhead in Mt. Meakandake, 1♂1♀, 23-IX-1996, N. Tsurusaki. Katô-gun, Kamishihoro-chô, Nukabira, 1♀, 20-VIII-2003, Y. Ihara; between Horoka to Mitsumata, 1♂, 21-VIII-2003, Y. Ihara. Shikaoi-chô, northern lakeside of Shikaribetsu Lake: 1♂3♀, 20-VIII-2003, YI; 1♀, 20-VIII-2003, Aisa Hatsushiba. Ashoro-gun, Ashoro-chô: the Biribetsu basin, 3♂2♀, 23-VIII-1992, Kiminori Miyashita; Mt. Meakandake, Onneto, 2♂3♀, 23-IX-1996, N. Tsurusaki.

Variation. Shape of patellar apophysis of male palp varies among populations as shown Fig. 6A-D, although a detailed geographic variation has not been investigated.

Remarks. *Cybaeus aokii* most resembles to *C.*

hatsushibai in body size and coloration. Legs of *C. aokii* are shorter than those of *C. hatsushibai*, although carapace length of *C. aokii* is as long as that of *C. hatsushibai*. Ratio of length of tibia I to carapace of *C. aokii* are 0.69 in male and 0.60 in female compared with 0.78 in male and 0.67 in female of *C. hatsushibai*.

Geographic distributions of the group

Species of the group are allopatric as shown in Fig. 7. *Cybaeus hatsushibai* has been collected only from the type locality, which is located in the southernmost part of central Honshu (the Kii Peninsula), while *C. aquilonalis* is widespread in central and northeastern parts of Honshu and the southwestern part of Hokkaido. On the other hand, *C. aokii* is endemic to Hokkaido and is distributed mainly in the central and eastern area of the island. This species is also known from Mt. Yôtei in the southwestern area and Haborochô in northern area of Hokkaido (Matsuda 1997, 2000). Thus, *C. aquilonalis* and *C. aokii* may be parapatric one another rather than allopatric in Hokkaido. Difference in body size between the two species is rather conspicuous (Fig. 8).

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